REMARKS

Claims 2-6 are allowed. Claims 1 and 7 were rejected as unpatentable over Marko in view of Kost. Claims 8 and 9 were objected to as depending on rejected base claim 7. Applicant requests reconsideration.

The examination has made technical errors in interpreting Kost. On page 2 of the detailed action, it is stated beginning on line 7, "However, since the claims define channelizing as the use of a plurality of A/D conversion circuits clocked by a polyphase clock generator, thus creating a plurality of digital channels, i.e., signal paths, from a complex baseband signal." The examination mistakenly states that Kost teaches channelization. Channelization involves separating a wide band signal into a plurality of frequency band signals. In claim 1 and claim 7, the limitations recite a polyphase filter bank and a transform processor, that function to separate the digital signals into respective frequency bands.

A conventional method to accomplish the channelization, termed the direct analog channelization method, is to input the composite signal of bandwidth B into a bank of M analog filters each with bandwidth B_T/M but with different center frequencies where M is the number of channels. Yet another method termed direct digital channelization method is to convert the input signal into digital form and replace each of the analog bandpass filters in the filter bank by a digital bandpass filter. Thus, the key component in terms

of the functionality of the channelization process is the bank of filters and not the ADC as the analog implementation can work without the ADC, however, the digital implementation cannot work without the bank of filters. The reason to prefer digital implementation compared to analog implementation is more in terms of size, weight, power, and other requirements.

In the direct digital implementation, each of the digital bandpass filters has to operate at a rate equal to the sampling rate R_T of the input bandpass filter which by Nyquist's theorem has to be at least equal to $2B_T$ and have a relatively large number of coefficients N_T in its FIR implementation which is generally preferred due to some important features such as guaranteed stability, numerical robustness, and linear phase response compared to alternative IIR filter implementation. In some real life applications N_T may be equal to several thousand. The length of the filter determines the size of the hardware required for implementation.

Kost teaches the generation of a digital form of the complex baseband signal in the form of multiple digital substreams but these substreams by themselves do not correspond to the desired channelized signals into frequency bands. Kost only teaches sampled digital substreams are combined back to finally generate a digitized version of the complex baseband IF signal which is only a first step in the direct digital implementation of the channelizer. The functionality of the necessary second step requires a bank of digital bandpass filters or some mathematically equivalent

configuration, which is not taught by Kost. Thus, Kost does not teach any solution whatsoever to the problem of channelization into frequency bands, which is the problem solved in the present invention.

Because Kost merely converts the complex baseband signal into a single digital stream, after compensating for the gain and dc offsets in the individual substreams. Thus, Kost only accomplishes the first digitization step of the channelization process. Kost never teaches polyphase channelization. In the polyphase channelizer in the present invention, each of the polyphase filters has only the length $L = N_T/M$ and operates at a sampling rate $R = R_T/M$ providing tremendous advantages when M is large as is usually the case in the applications for which this invention is most beneficial.

To summarize, generation of a number of digital streams from an analog complex baseband or an IF signal as in Kost does not comprise the polyphase channelization process whatsoever. Each of the substreams, after the gain and dc offset compensation in Kost, occupy the same frequency band that is not a plurality of staggered frequency bands as is required for polyphase channelization. The various substreams in Kost are staggered in time but not in their center frequencies in the frequency domain. Only after these streams are processed by a bank of polyphase filters and the FFT processor as in the present invention, does one obtain the channelized outputs wherein each of the individual streams at the

output of the FFT processor has a bandwidth of B_T/M with staggered center frequencies and sampling rate reduced to R_T/M.

On page 4 of the examination, beginning on line 12, it is stated that "Kost et al further teach a polyphase filter bank of filters (78, 80, 82 and 84) for respectively filtering the sampled I and Q quadrature baseband signals." This statement is another error in interpreting Kost. Kost does not in anyway teach a polyphase filter bank of filters.

Kost does not teach the use of any polyphase filtering. The combination of elements 78, 80, 82 and 84 in Figure 4 of Kost does not constitute any filter polyphase or otherwise. Rather, the combination of elements 78, 80, 82 and 84 provides only a correction to any gain and dc offset mismatch in the ADC's in the bank. If for example, the ADCs in Figure 4 of Kost do not have any significant mismatches as would be the case for the case of matched ADCs as is often done in practice in some very important applications, then the combination of elements 78, 80, 82 and 84 would be entirely absent in Figure 4 of Kost. Thus, Figure 4 of Kost does not include the functionality of the polyphase filter in it.

The concept and the functionality of the polyphase filtering is completely absent in Kost. The combination of summers and multipliers 78, 80, 82 and 84 in Figure 4 of Kost are only for gain adjustment and dc offset adjustment. In the bank of polyphase filters of the present invention, each of the polyphase filters has

an impulse response associated with it and has a certain relationship to the impulse responses of other polyphase filters such that the totality of the polyphase filters along with the FFT processor behaves as mathematically equivalent to the bank of digital bandpass filters used in the direct digital implementation but with the tremendous advantages in terms of speed and the amount of hardware required for implementation both of which are reduced by factor M. Thus, for the case of M = 256 for example, both the speed and size of the hardware required to implement the filters are reduced by a factor of 256 compared to the direct digital implementation. When the bandpass and the polyphase filters are implemented as FIR filters as is mostly done in practice, then the impulse responses of the polyphase filters are simply the staggered subsequences of the impulse response sequence of the digital filter with center frequency equal to 0 in the direct digital implementation.

By comparison, the combination of elements 78, 80, 82, and 84 in Figure 4 of Kost does not have a polyphase filter or any filter for that matter associated with each of the ADCs. The combination of elements 78, 80, 82, 84 in Figure 4 of Kost merely provides an adjustment of DC offset and a gain, which does not provide any filter functionality, as the filter functionality provides a frequency dependent behavior achieved by the proper impulse response of the filter. Also, Kost does not have an FFT processor or any equivalent as an essential component of the channelizer described in the present invention. The lack of polyphase filters and FFT processor or any equivalent thereof clearly shows that Kost

does not solve the problem of channelization which is the problem solved in the present invention. Rather, Kost only solves the problem of analog to digital conversion using multiple ADCs.

Marko shows a complex base band signal whereas Kost teaches a real signal as the input, but neither teach polyphase channelization and certainly no staggered sampling for polyphase channelization. The combination of Marko and Kost does not teach or suggest a bank of polyphase filters and a transform processor for polyphase channelization which will be absent in an architecture obtained by replacing the ADC in the Marco's receiver by the ADC architecture taught by Kost as suggested by the examiner. Allowance of all of the claims is requested.

Respectfully Submitted

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